

DOCUMENT RESUME

ED 174 678

TM 009 650

AUTHOR Thompson, Patricia; And Others
TITLE Interrelationships Among Five Cognitive Style Tests, Student Characteristics, and Achievement.
PUB DATE Apr 79
NOTE 31p.; Paper presented at the Annual Meeting of the American Educational Research Association (63rd, San Francisco, California, April 8-12, 1979)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Age Differences; *Cognitive Style; *Cognitive Tests; College Credits; College Majors; *Comparative Testing; Grade Point Average; *Grades (Scholastic); Higher Education; Locus of Control; Predictor Variables; Sex Differences; *Student Characteristics; Test Validity

IDENTIFIERS Grasha-Riechmann Student Learning Style Scales; Group Embedded Figures Test (Witkin); Learning Style Inventory (Kolb); Mehrabian Stimulus Screening Test; Nowicki Strickland Locus of Control Scale

ABSTRACT

Using college freshmen enrolled in a learning analysis course, the relationship between five tests of cognitive style was investigated: (1) Group Embedded Figures Test; (2) Grasha-Riechmann Student Learning Style Questionnaire; (3) Adult Nowicki-Strickland Locus of Control Scale; (4) Mehrabian Stimulus Screening Test; and (5) Kolb Learning Style Inventory. The relationship between these measures and other student variables was also considered; the student variables included choice of major; interest in various disciplines; cumulative grade point average; grades within subject disciplines; credit hours within disciplines; course achievement; age; and sex. Results indicated that the Learning Style Inventory subscales were essentially independent of the other measures, and that the Grasha-Riechmann Questionnaire demonstrated inconsistent relationships among subscales and with the other measures. The Group Embedded Figures Test (GEFT) demonstrated consistent and meaningful relationships across samples, and with educational outcomes such as choice of major, interests, achievement, and credit hours. In contrast to previously reported research, GEFT scores were repeatedly related to measures of achievement. The other four tests were judged to be not useful in studying the educational variables investigated in this research. (Author/GDC)

* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *

ED174678

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

Interrelationships Among Five Cognitive Style Tests,
Student Characteristics, and Achievement

Patricia Thompson, Deana Finkler, and Steve Walker
University of Nebraska

8.18

PERMISSION TO REPRODUCE THIS
MATERIAL HAS BEEN GRANTED BY

D. Finkler

TO THE EDUCATIONAL RESOURCES
INFORMATION CENTER (ERIC)."

TM009 650

Paper presented at the annual meeting of the American Educational
Research Association in San Francisco, April 1979.

Interrelationships Among Five Cognitive Style Tests, Student Characteristics, and Achievement

Patricia Thompson, Deana Finkler, and Steve Walker

Purpose and Perspective

The research described below attempts to answer the following questions: What are the relationships between scores on five cognitive style tests, and between scores on these tests, student characteristics, and achievement in different disciplines for college students? Current interest in the matching of student learning styles to instructor teaching styles (Kolb, 1976) suggests that these questions are relevant precursors to investments in programs purporting to arrange such matches.

The decision on how to conceptualize cognitive style in a way which can be quantitatively related to student characteristics and/or achievement in various disciplines is restricted by the availability of measures of cognitive style. For those which are available, little is known about their interrelationships, except between measures of field independence which themselves vary as a function of testing method (See Kogan, 1971 for a review). In addition, little is known about the relationships between measures of cognitive style, student characteristics, and achievement, with the exception of field independence which has been applied to a variety of educational issues (Witkin et al., 1977a, 1977b). Authors of cognitive style tests postulate numerous dimensions in the domain of cognitive style, yet few describe them in detail. If these measures can make unique contributions to students' understanding of their learning styles, then their utility for educators awaits demonstration of relationships to educational processes and outcomes. If they are not unique, then this too remains to be demonstrated as well as their educational implications.

Data Source and Method

SAMPLE

Data were collected describing students enrolled during two consecutive semesters of an experimental Learning Analysis (LA) course. LA is a component of the University of Nebraska FIPSE project "Helping Students Become More Sophisticated Consumers of Their Own Education." It is a primarily freshman level course intended to help students understand their own learning reactions in a variety of instructional contexts. LA includes an introductory unit on learning styles during which cognitive style tests are administered and interpreted followed by four three-week instructional units, each taught by different instructors. A wide diversity of disciplinary content and teaching methods were utilized across the schools participating in the LA project as can be seen in Table 1.

Data were collected during the Fall of 1977 and the Spring of 1978. Because the four institutions included in the study began teaching LA at different times, samples across the two semesters are different (See Table 1, Note 2).

The Fall, 1977 sample consisted of 139 LA students enrolled at the University of Nebraska-Omaha (UNO) and 86 enrolled at the University of Nebraska-Lincoln (UNL). The Spring, 1978 sample consisted of 76 and 34 LA students from UNO and UNL respectively, as well as 31 enrolled at Chadron State College (CSC) and 12 from Kearney State College (KSC).

COGNITIVE STYLE MEASURES

The cognitive style measures used in LA varied somewhat across institutions and semesters. Selection of the measures

was based on quality of related research and its educational implications, administration time, ease of interpretation in the classroom, and an attempt to minimize overlap of information. Five measures were used during the two semester period of concern. Each measure of cognitive style is briefly described below. Table 2 lists measures given at the four institutions during the two semester period. Table 3 contains a comprehensive list of cognitive style measures given including their subscales and abbreviations which will be used throughout this paper.

Group Embedded Figures Test (GEFT). The GEFT is a group bipolar measure of field independence/dependence (Oltman, et al., 1971). Subjects are given 12 minutes to find simple figures embedded in a series of 18 complex geometric designs. Practice problems are included. Scores range from 0 to 18 depending on how many of the embedded forms were correctly identified.

Field independence (FI) versus field dependence (FD) is interpreted as measuring an analytical versus a global way of perceiving. Of the various measures of cognitive style, "the field independence-dependence dimension is unquestionably the most widely known and thoroughly researched" (Kogan, 1971). Research on the GEFT and other measures of FI FD by Witkin and his associates has been ongoing for approximately twenty-five years. This study attempted to replicate some previous findings of Witkin and his associates regarding FI-FD relationships with choice of major and achievement (see Witkin et al., 1977a, 1977b).

Grasha-Riechmann Student Learning Style Questionnaire (GRSLSQ). The General Form of the GRSLSQ consists of six subscales which describe student responses in classroom learning situations. They are Independent, Dependent, Participant, Avoidant, Collabor-

ative, and Competitive subscales.

Riechmann and Grasha (1974) employed a rational approach to selecting scale and criteria items. Final items were selected based on reliability coefficients between criteria and subscale items. The scale consists of 90 statements, 15 per subscale, to which students respond indicating degree of agreement. A high score on a particular subscale indicates that the student's learning style is characterized well by that dimension.

Adult Norwicki and Strickland Locus of Control Scale (ANS-IE). The ANS-IE is a locus of control measure for college and noncollege adults which attempts to identify the degree of internal or external locus of generalized expectancies of reinforcement, as defined by Rotter (1966). The ANS-IE measures locus of control independent of social desirability (Nowicki and Duke, 1974).

The measure consists of 40 self-descriptive statements derived from social learning theory in general and Rotter's (1966) definition of the locus of control dimension specifically (see Norwicki and Duke, 1974). Subjects respond to the statements by answering either "yes" or "no". A high score represents agreement with "external" statements and disagreement with "internal" statements. Scores may range from 0 to 40 where 0 represents an entirely internal locus of control and 40 represents an entirely external locus of control.

Mehrabian Stimulus Screening Test (MSST). The MSST is a measure of individual differences in spontaneous response to the rate of environmental information, what Mehrabian calls sensitivity to or ability to screen out irrelevant stimuli. Mehrabian developed this verbal scale to measure individual differences in stimulus screening and arousability (Mehrabian, 1976). It contains

40 statements to which the subject indicates degree of agreement on a nine point scale (+4 to -4). The statements include reactions to stimulation using all of the senses. High scores indicate high sensitivity to both positive and negative environmental and interpersonal events. Persons with high scores are described as "screeners". In contrast, "nonscreeners" score low, indicating low sensitivity or arousal by the same events. Research has shown that females screen less (i.e. they are nonscreeners) than males and that high achievers tend to screen more (i.e. they are screeners) than low achievers (Mehrabian, 1976).

The Kolb Learning Style Inventory (LSI). The LSI was developed to measure individual learning styles derived from experiential learning theory (Kolb, 1976). According to the technical manual, there were three major objectives in designing the inventory: 1) the test should be brief and straightforward so that learning style feedback can be utilized in the learning process and in research, 2) the test should allow the student to respond to it in a way similar to responding to a learning situation (i.e. balancing opposing tensions in learning situations should also be required by the test), and 3) the test should be a valid measure of learning styles in that it can predict behavior consistent with theory.

The test consists of nine sets of four self-descriptive adjectives. For each item the respondent is to rank order the four words in a way best describing his/her learning style. One word in each set corresponds to one of four learning modes - Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). The LSI measures the respondent's relative emphases on the modes based on

the four sums of rankings. The LSI also determines the extent to which the respondent emphasizes abstractness over concreteness (AC-CE) and the extent to which the respondent emphasizes action over reflection (AC-RO). A learning style description based on the percentile ranks of the learning modes used can also be determined.

STUDENT CHARACTERISTICS

Data concerning student characteristics were collected during the introductory unit of LA and included: sex, age, major, and self-ratings of interest in taking courses in 12 discipline areas. Data on these student characteristics were collected only during the Fall, 1977 semester (see Table 2).

STUDENT GPA AND HOURS IN ACADEMIC FIELDS

Fall, 1977 grade reports were obtained for students enrolled in LA at both UNO and UNL. The grade reports provide information regarding cumulative GPA and hours, course GPA and hours, and semester GPA. GPA's and hours were also computed separately for credits earned in these academic fields: 1) Social Sciences, 2) Natural Sciences, 3) Humanities, 4) Business, 5) Education, and 6) Other. The last category included GPA's and hours taken primarily in Home Economics and Agriculture, since these were not readily classified elsewhere. In addition, courses in Engineering and Mathematics were placed in the Natural Science category while Fine Art courses were considered to be primarily Humanities courses.

STUDENT LA ACHIEVEMENT

Final grades in LA for all institutions were given on a pass/fail basis. Achievement data at some institutions has little

or no variability for a given semester. However, there was sufficient variability for data analysis for semester achievement data where passes and fails were determined using a point system or where as many students failed as passed the course. Articulated grades for some LA instructional units at UNO and UNL were also available. In general, achievement within instructional units lacked variability, particularly where unit achievement was determined on a pass/fail basis. However, several instructors determined grades using continuous data from tests, papers, or based on a point system.

Results and Discussion

INTERRELATIONSHIPS AMONG COGNITIVE STYLE TEST SCORES

Means and standard deviations of cognitive style test scores were similar to those of the college norm groups described in those test manuals which provide such information. Table 4 contains all statistically significant correlations ($p < .05$) found between the cognitive style measures or subscales. The top half of the matrix presents the correlations for Fall, 1977 and the lower half of the matrix presents the Spring, 1978 results. Correlations for each school are reported separately unless they were in the same direction and significant for all schools during the semester, in which case the correlation for the combined data is reported.

GEFT, ANS-IE, and MSST scores were not intercorrelated ($-.0005 \leq r \leq .16$). Thus, these three scales appear to be independent of one another. This might be surprising if one were to consider only the names of the styles the scales purport to measure.

For example, based on cognitive style names, one might expect the measures of field independence, locus of control, and stimulus screening to be related because the field independent makes judgments independent of field constraints, the internal feels able to control outcomes independently of fortune, and the screener screens information independently of background information. Similarly, the GRSLSQ independent and dependent subscales identify independence as a central characteristic. However, this expectation makes the assumption that the name given to a cognitive style does in fact characterize that style well. Apparently this assumption is not correct as even the Independent and Dependent subscales of the same GRSLSQ measure did not relate consistently with each other ($-.51 \leq r \leq .23$). Likewise, the "Independent" and "Dependent" subscales of the GRSLSQ never significantly correlated with the GEFT measure of field independence and dependence. The measures appear to be tapping different aspects of cognitive style. Looking beyond the names given to the measures to the nature of the tasks themselves, this result is not surprising. The tasks involved in these measures vary from perceptual (GEFT) to verbal self-report (ANS-IE, MSST, GRSLSQ) and the task domains vary from the cognitive-perceptual (GEFT, MSST) to the social (ANS-IE, GRSLSQ).

The interrelationships among the GRSLSQ subscales proved to be complex. If the GRSLSQ subscale titles do in fact describe that style well, it seems logical to hypothesize the following: 1) GR1:IND scores should be negatively correlated with GR4:DEP scores, 2) GR2:AVOD scores should be negatively correlated with both GR3:CLAB and GR6:PART scores, and 3) GR3:CLAB scores should be positively related to GR6:PART scores. In fact, these were bases for the original formation of the subscales.

Significant negative correlations were found between GR1:IND

and GR4:DEP scores for 3 of the 6 possible cases ($-.51 \leq r \leq -.29$, $p \leq .01$), but one significant positive correlation was also found between these subscales ($r = .23$, $p < .05$), indicating inconsistent relationships between GR1:IND and GR4:DEP. Only 2 of the 6 possible correlations between GR2:AVOD and GR3:CLAB were significant. However, there were four negative correlations between GR2:AVOD and GR6:PART ($-.72 \leq r \leq -.5$, $p \leq .01$) as expected. Four of the 6 correlations between GR3:CLAB and GR6:PART were significant. As predicted, these were all positive ($.30 \leq r \leq .45$, $p \leq .01$).

For the 11 remaining possible ways of comparing the GRSLSQ subscales, only 3 of the subscale comparisons were consistent across semesters. The remaining 8 comparisons indicated positive correlation(s) for one semester and negative correlation(s) for the other, or yielded significant correlations for one semester only. In summary, inconsistent relationships between the GRSLSQ subscales were found for 11 out of the 15 possible comparisons between the subscales.

The GRSLSQ subscales are most meaningfully related to the MSST where half of the possible correlations were significant ($p < .05$). Screeners tend to be independent (GR1 $r = .24$), avoidant (GR2 $r = .26$), noncollaborative (GR3 $r = -.36$), not dependent (GR4 $r = -.13$), and not participant (GR6 $r = -.25$). GRSLSQ subscales 2 and 6 related meaningfully to the ANS-IE in 4 of 12 possible cases. For example, externals' scores were more avoidant ($.36 \leq r \leq .43$) and nonparticipant ($-.25 \leq r \leq -.23$). GR2:AVOD was the only GRSLSQ subscale which was at all related consistently with the LSI; three of four possible correlations of GR2:AVOD with LSI:CE were positive, 2 of 4 with LSI:AC were negative, and 3 of 4 with LSI:AC-CE were negative, indicating that avoidants tend to use concrete experiential

modes of learning.

The MSST Fall, 1977 data did not correlate with other measures except subscales of the GRSLSQ. MSST correlated significantly with 4 out of the 6 GRSLSQ subscales for data from only one of the two institutions. Only the correlation for one comparison was significant for both schools, and the correlation for the combined data is small ($-.13, p < .05$).

Predictions concerning interrelationships between the LSI subscales could be made as follows: 1) LSI:AE-RO should positively correlate with LSI:AE and negatively with LSI:RO because the former is merely a linear combination of the last two, and 2) LSI:AC-CE should positively correlate with LSI:AC and negatively with LSI:CE for the same reason above. As expected both of these predictions were supported. Each of the four correlations were significant and in the predicted direction for every school, as can be seen in Table 4.

There were inconsistent relationships between some of the other mode scales. For example, the LSI subscales AC and CE were negatively correlated at two of the four schools ($-.48 \leq r \leq -.32$) but were positively correlated at a third ($r = .24$). Similarly, only three of the four correlations were not significant between LSI subscales CE and RO, AE and RO, and also between AE and AC.

The relationships among LSI and GR2:AVOD subscales are described above. LSI:AC-CE scores were related to the ANS-IE in the two larger of the four schools ($r = -.37$) indicating that externals tend to use concrete experiential modes of learning more than abstract conceptualization. LSI subscales were positively related to the MSST in 3 of 6 cases.

To summarize, the GEFT, ANS-IE, and MSST scales appear to contribute independent information. The Kolb LSI appears to be relatively independent of these scales as well and reasonably internally consistent across subscales. The GRSLSQ subscales relate variably across schools and semesters to the other measures of cognitive style, and relate inconsistently among themselves. Thus, users of the GRSLSQ may expect differential internal and external concurrent validities for the six subscales.

COGNITIVE STYLE MEASURES AND STUDENT CHARACTERISTICS

Data for UNO and UNL from the Fall, 1977 semester were combined for sex by major ANOVA's with cognitive style measures as the dependent variables. Major was divided into six categories: social science, natural science, humanities, business, education, and other. The last category included data for persons primarily in home economics or agriculture.

The 2 X 6 ANOVA for GEFT scores yielded only a significant main effect for major ($F=4.50, df=5/97, p<.001$). Similar to Witkin's results, those in education ($\bar{X}=8.0, n=21$) and social science ($\bar{X}=10.25, n=13$) had the lowest GEFT scores while those in the natural sciences ($\bar{X}=13.88, n=18$) had the highest GEFT score. Persons with majors in humanities ($\bar{X}=13.4, n=17$), business ($\bar{X}=10.4, n=41$), and other ($\bar{X}=10.0, n=5$) were between these extremes. This finding replicates the findings of Witkin et al. (1977b).

The 2 X 6 ANOVA's for the six GRSLSQ subscales yielded three instances where main effects for both sex and major were significant ($p<.05$). This was true for GR2:AVOD, GR5:COMP, and GR6:PART. In addition, a significant main effect for sex was found for GR3:CLAB. No significant interactions were found for any of the

GRSLSQ subscales, nor for any other measure of cognitive style. Inspection of the means indicated that males were more avoidant and competitive, and were less collaborative and participative than females. Patterns of means for majors varied over subscales. Means and standard deviations, as well as F values, for each of the significant main effects can be found in Table 5.

No significant sex or major main effect or interaction was found for the ANS-IE measure. This fails to replicate the usual sex difference in which males are more internal than females. For the MSST, however, a main effect for sex was found replicating Mehrabian's finding (1976) that females tend to screen less than do males (see Table 5).

Correlations were calculated for the Fall, 1977 data between the cognitive style measures and self-reported interest in 12 discipline areas (1=high interest, 5=low interest). GEFT scores were negatively correlated with self-reported interest in Math (-.26), Engineering (-.25), and Physics (-.21), and positively related to interest in Education (.30), Speech Communication (.22), and English (.20). Thus, field independent persons reported more interest in the natural sciences and field dependent persons in education and humanities. This is consistent with the earlier result regarding GEFT relationship with major in six fields.

The ANS-IE was positively correlated with interest in Speech Communication (.26) and English (.25). Externals reported less interest in these areas than did internals.

Scores on the MSST were negatively related to interest in Engineering (-.20) but were positively related to interest in Foreign Languages (.19). Screeners, who are more often male,

reported higher interest in Engineering than did nonscreeners, who are more often female, and screeners reported less interest in Foreign Languages than did nonscreeners. This may be confounded by sex, although interest in other sex-typed areas (eg. Natural Science, Education) did not show this relationship.

Scores on the GR1:IND subscale negatively correlated with interest in Biology (-.18), English (-.21), and Fine Arts (-.21), indicating high interest in these areas by the more independent students. Students with high avoidant scores (GR2) indicated low interest in all of these fields: Psychology (.38), Speech Communication (.32), Foreign Language (.27), Education (.26), English (.24), and Biology (.23). Apparently students with high avoidant scores are generally disinterested in academic study, almost regardless of the discipline. In contrast, students with high GR3:CLAB scores indicated high interest in many fields, primarily disciplines where interaction and group effort take place: Speech Communication (-.23), English (-.24), Foreign Language (-.23), Education (-.20), and Fine Arts (-.19). GR3:CLAB results are similar, as expected, to those for GR6:PART where high participant scores were related to interest in some of the same disciplines: Speech Communication (-.23), Fine Arts (-.20), and Psychology (-.19). The remaining two subscales, GR4:DEP and GR5:COMP, did not correlate significantly ($p < .01$) with any of the interest ratings.

COGNITIVE STYLE, STUDENT GPA, AND HOURS IN ACADEMIC FIELDS

Student GPA and hours in academic fields for the Fall, 1977 samples were computed separately for the same 6 discipline categories previously used. In addition, data for cumulative GPA's

and semester GPA's were also analyzed. All possible relationships between cognitive style measures, GPA, and number of hours were explored. Thus results will be reported starting with the most global test.

Cognitive Style, Cumulative, and Semester GPA. Correlations between cognitive style measures and cumulative GPA's were computed separately for the UNO and UNL Fall, 1977 samples as grading practices and scales differed at these campuses. Correlations were also computed where data for the samples were divided into freshmen (hours $\leq$ 30) versus non-freshmen (hours $>$ 30). The only significant correlations for the UNO sample were between cumulative GPA and GEFT for non-freshmen ($r=.68, p<.01, n=17$) and GPA and GR3:CLAB for non-freshmen ($r=.69, p<.01, n=14$). Non-freshmen with higher GPA's tended to be more independent and more collaborative than those with lower GPA's.

Different relationships existed in the UNL sample, as grading practices may be more discriminating at UNL than at UNO. GPA and GEFT scores were correlated for the entire UNL sample ($r=.23, p<.05$) but not with smaller subsets of freshmen and non-freshmen. Recall that Witkin reports no relationship between cumulative GPA and GEFT. GPA and GR1:IND were inconsistently related at UNL for both cumulative and semester data. Significant correlations for both freshmen and non-freshmen ranged from $-.29$ to $.65$ ($ps<.05$). Cumulative GPA and GR5:COMP were related for freshmen ($.29$) and the entire sample ($.28$).

Cognitive Styles and GPA in fields. Correlations between cognitive style measures and GPA's in 6 discipline areas can be found in Table 6. Only 12 of the possible 102 correlations were significant ($p<.05$). Of some interest is the result that at UNL

students with more field independent GEFT scores tended to have higher GPA's in the Natural Sciences ($r=.32, p<.05, n=34$), and at UNO, students with high GR6:PART scores had higher GPA's in 4 of the 6 discipline areas (see Table 6 for these and other r's).

Cognitive Style and Hours in Field. Two consistent findings across both schools were found: 1) Field independent students, as measured by the GEFT, had more hours in the Natural Sciences (UNL: $r=.34, p<.01, n=62$; UNO: $r=.23, p<.01, n=122$), and 2) students with high GR5:COMP scores also had more hours in the Natural Sciences (UNL: $r=.23, p<.01, n=63$; UNO: $r=.19, p<.05, n=109$). In addition, UNL students with more field independent GEFT scores had fewer hours in Education ($r=-.22, p<.05, n=62$). One last finding worth noting was that UNO students with more hours in Education had internal loci of control ($r=.27, p<.001, n=123$) and tended to be screeners ($r=.20, p<.05, n=128$). Table 7 contains these and all other significant correlations between the measures and hours in academic fields.

Hours and GPA in Field. Correlations between number of hours in a field and GPA in the same field were computed for the two samples. Only two correlations were significant and can easily be explained. Hours and GPA in Education were related for the UNL sample ($r=-.76, p<.01, n=39$). This was spurious because the sample largely consisted of university athletes taking P.E. courses where they received an "A" in every case. Thus, although they took P.E. courses with few credit hours, they had high GPA's in "education". The other significant hour and GPA correlation was for the discipline category "Other" at UNO which is not readily interpretable.

Cognitive Style and Student Achievement in LA. Overall LA

achievement for all schools and semesters was on a pass/fail basis, except for UNO Spring, 1978 data. The scale used for most achievement data was: 1=pass, 2=incomplete, 3=drop, 4=withdrawl, and 5=fail. However most data consisted of passes and fails. One way ANOVA's across the 5 categories of grades were performed using each cognitive style measure as dependent variables. The only significant ANOVA for the Fall, 1977 samples on any measure was for GEFT scores at UNL ($F=3.13, df=3/56, p<.05$). Students who dropped ($n=2$) or failed ($n=17$) the course were more field dependent than students who had incompletes ($n=6$) or passed ($n=37$) the course. Respective means were 6.00, 7.06, 13.17, and 10.84.

Spring, 1978 data was only analyzed for UNO and CSC because data from the other campuses did not contain sufficient variability to warrent analysis. For example, everyone at KSC passed the LA course. Because CSC data consisted of only two groups, those who passed versus those who dropped or failed, t-tests were run on this data. Significant ts ($ps<.05$) were found for GR2:AVOD ($t=2.15, n=31$), GR4:DEP ($t=-2.11, n=31$), and LSI:AE ($t=2.59, n=29$). Students passing the course had a higher GR2:AVOD mean ($\bar{X}=41.2$) than those failing the course ($\bar{X}=34.5$). In contrast, those failing the course had a higher GR4:DEP mean ($\bar{X}=54.4$) than those passing ($\bar{X}=50.2$). For the LSI:AE subscale, students passing the course ($\bar{X}=16.3$) had a higher mean than those who failed ($\bar{X}=14.4$).

Correlations were tested for UNO Spring, 1978 data between cognitive style measures and achievement because the later was on a point system (range 0 to 100). Significant correlations were found between overall achievement and GEFT ($r=.22, n=73$), LSI:AC ($r=.25, n=54$), and LSI:AC-CE ($r=.31, n=54$). In other words,

those who performed best overall in LA also had higher scores on these tests.

Achievement for the individual units was usually on a pass/fail basis and was even less variable than overall achievement. Thus, the relationships between cognitive style measures and unit achievement could not be determined in most cases. However, during one semester at UNL and one at UNO, unit achievement was articulated and could be evaluated as a function of cognitive style.

During the Fall, 1977 semester, LA unit achievement at UNL for the segments taught by lecture (Folklore) and lecture-discussion (Geography; see Note 2 on Table 1) were based on a 13 point scale (1=F, 2=D-, 3=D, ..., 13=A+). When data for these units were separately correlated with measures of cognitive style, both were significantly related only to the GEFT. The correlation for lecture was .35 and for lecture-discussion .28 ($p < .01$, $n = 74$). GEFT was also significantly correlated with achievement in the Keller Plan (Psychology) unit where a 0 to 28 point scale was used ($r = .39$, $p < .001$, $n = 74$). Achievement in the Keller Plan also was related to the MSST ($r = -.21$, $p < .05$, $n = 72$). Thus, field independents did better in these three units than field dependents and screeners also did more poorly in the Keller Plan unit. Articulated achievement for the remaining unit was not available.

UNO achievement data provided articulated data for all five units, including the introductory unit. A 0 to 20 point scale was available for each of the separate units but variability was often low. For the Spring, 1978 data, the GEFT was positively related to achievement in the lecture (Physics) and lecture-discussion (introductory) units ($.20 \leq r \leq .29$). GR2:AVOD was

negatively related to achievement in the open classroom (English; $r = -.36, p < .01, n = 63$), a unit which requires self-initiated learning by the student. Kolb LSI:RO scores were negatively correlated with achievement in the open classroom ($r = -.25, p < .05, n = 54$) and introductory ($r = -.32, p < .01, n = 54$) units. LSI:AC scores were positively related to achievement in the lecture and experiential (Speech Communication) units ($.25 \leq r \leq .26, p < .05, n = 54$).

Conclusions

One purpose of this study was to evaluate the relationships among five measures of cognitive/learning style readily used in classroom settings which appear to be potentially related to educational outcomes. Another purpose of this study was to evaluate the relationships among these measures and such educationally important variables as 1) choice of major, 2) interest in various disciplines, 3) cumulative GPA, 4) GPA within disciplines, 5) hours in disciplines, 6) achievement in Learning Analysis and instructional units within LA, as well as 7) the student characteristics of age and sex. If these measures contribute independently to students' understanding of their learning styles and are related consistently across schools and time to educationally relevant behaviors, then each may be important to explore in a course like LA or in other academic advisement settings. If they provide redundant information or are not related to educational outcomes, then their use in such settings should be questioned.

The results demonstrated the independence of the GEFT, ANS-IE, and MSST measures of cognitive style across four schools during two semesters. The Kolb LSI subscales were only occasionally

related to these measures and may be considered essentially independent of them. The GRSLSQ scales, however, demonstrated inconsistent subscale interrelationships as well as inconsistent relationships to other measures over schools and time. Users of the GRSLSQ may therefore expect differential internal and external validities for the six subscales. This is unfortunate as it is one of the most available, and easily used scales, and it appears to have considerable face validity to students.

Only the GEFT appears to demonstrate consistent and meaningful relationships across schools and time to such academically important outcomes as choice of major, interest in various disciplines, cumulative GPA, hours taken and GPA in science, and achievement in LA. Results concerning GEFT scores either replicate or are similar conceptually (eg. choice of major and interest in disciplines) to results reported by Witkin, et al. (1977a, 1977b), except for the relationships found between the GEFT and achievement. Witkin, et al. report no relation between cumulative GPA and GEFT. However, cumulative GPA and other measures of achievement were repeatedly related to GEFT scores in the limited samples used here. These findings may be a function of numerous factors such as 1) the experimental nature of the LA course, 2) the primary enrollment of freshmen in the course, and/or 3) perhaps an extremely self-selected group of students in LA based on other dimensions. In any case, further study of the relationships between the GEFT and achievement within different academic areas is warranted.

The educational utility of the other four measures of cognitive style is questionable. None of the remaining four measures

consistently related to the educational outcomes studied here. They may, however, be important in the study of educational processes which were not studied here such as the relationship of LSI learning modes to style of interaction or of MSST styles to efficacy of study under varying levels of noise.

References

- Kogan, Nathan. Educational implications of cognitive style. In Gerald Lesser (Ed.), Psychology and Educational Practice. Scotts-Foresman, 1971.
- Kolb, David A. Learning Style Inventory: Technical Manual. Boston: McBer and Co., 1976.
- Mehrabian, Albert. Manual for the Questionnaire Measure of Stimulus Screening and Arousability. University of California Press, UCLA, 1976.
- Nowicki, Stephen and Duke, Marshall P. A locus of control scale for noncollege as well as college adults. Journal of Personality Assessment, 1974.
- Oltman, P. K., Raskin, E., and Witkin, H. A. Group Embedded Figures Test, Consulting Psychologists Press, 1971.
- Reichmann, Sheryl W. and Grasha, Anthony F. A rational approach to developing and assessing the validity of a student learning styles scales instrument. Journal of Psychology, 1974, 87, 213-223.
- Rotter, J. B. Generalized expectancies for internal versus external control of reinforcement. Psychological Monographs: General and Applied, 1966, 80, no. 1 (Whole No. 609).
- Witkin, H. A., Morre, C. A., Goodenough, D. R., and Cox, P. W. Field-dependent and field-independent cognitive styles and their educational implications. Review of Educational Research, 1977a, 47, No. 1, 1-64.
- Witkin, H. A., Moore, C. A., Oltman, P. K., Goodenough, D. R., and Friedman, F. Role of the field-dependent and field-independent cognitive styles in academic evolution: A longitudinal study. Journal of Educational Psychology, 1977b, 69, No. 3, 197-211.

FALL 1977 & SPRING 1978

institution	content	instructional method
UNO	Physics	lecture-demonstration
	Speech Commun.	experiential
	Math	peer discovery
	English	open classroom (see Note 1)
UNL	Psychology	Keller plan
	Political Science	gaming and simulation
	Folklore	lecture
	Geography	experiential (see Note 1)

SPRING 1978

institution	content	instructional method
CSC	English	lecture
	Home Economics	Keller plan
	Business	simulation and gaming
	Industrial Ed.	discovery
KSC	Speech Commun.	interactive experiential
	Business	computer simulation
	Self Actualization	small group
	Adult Education	instructional design

Table 1. Content areas and teaching methods listed by institution and semester.

Note 1: Formative evaluation established that class size and/or facility restrictions limited application of the teaching methods during the semesters of this study. The instructional strategy used in the "open" classroom during Fall, 1977 might better be described as small group discussion and that used both semesters in the "experiential" class, lecture-demonstration.

Note 2: Fall, 1977 was the second time LA had been offered at UNO and the first time at UNL. Spring, 1978 was the first time LA was offered at CSC and KSC.

	Fall 1977		Spring 1978			
	UNO	UNL	UNO	UNL	CSC	KSC
<u>Cognitive Style Measures</u>						
GEFT	✓	✓	✓	✓	✓	✓
GRSLSQ	✓	✓	✓	✓	✓	✓
ANS-IE	✓	✓	✓	✓		
MSST	✓	✓	✓			
Kolb LSI			✓	✓	✓	✓
<u>Student Data</u>						
Sex	✓	✓				
Major	✓	✓				
Age	✓	✓				
Interest Ratings	✓	✓				
<u>Student Achievement Data</u>						
Cumulative GPA	✓	✓				
Semester GPA	✓	✓				
GPA in 6 fields	✓	✓				
hours in fields	✓	✓				
<u>Student LA Achievement</u>						
Overall for some units	✓	✓	✓	✓	✓	✓
		✓	✓			
	n=139	n=86	n=76	n=34	n=31	n=12

Table 2. A list of all data collected at all institutions during the two semester period.

1. Group Embedded Figures Test (GEFT)
2. Grasha-Riechman Student Learning Style Questionnaire (GRSLSQ)
 - Independent (GR: IND)
 - Avoidant (GR2: AVOD)
 - Collaborative (GR3: CLAB)
 - Dependent (GR4: DEP)
 - Competitive (GR5: COMP)
 - Participative (GR6: PART)
3. Adult Nowicki and Strickland Locus of Control Scale (ANS-IE)
4. Mehrabian Stimulus Screening Test (MSST)
5. Kolb Learning Style Inventory (LSI)
 - Concrete Experience (LSI: CE)
 - Reflective Observation (LSI: RO)
 - Abstract Conceptualization (LSI: AC)
 - Active Experimentation (LSI: AE)
 - Abstractness vs. Concreteness (LSI: AC-CE)
 - Action vs. Reflection (LSI: AE-RO)

Table 3. Comprehensive list of all cognitive style tests and their subscales used during the 1977-78 school year.

GEFT	GR1:IND	GR2:AVOD	GR3:CLAB	GR4:DEP	GR5:COMP	GR6:PART	ANS-IE	MSST	LSI:CE	LSI:RO	LSI:AC	LSI:AE	LSI:AC-CE	LSI:AE-RO
GEFT					.16*									
GR1:IND		UNL -.23*	UNO .21*	UNL -.29**	UNL -.25**	.30***		UNO -.24**						
GR2:AVOD		UNO .23*	UNL .44**		.27***	-.6***	.36***	UNL .26*						
GR3:CLAB			CSC -.50**		UNL -.25*	.35***	UNC .30**	UNL -.36**						
GR4:DEP		UNO .23* UNL -.44* KSC .51*	UNL .34*		.19**	UNL .25*		-.13*						
GR5:COMP		UNO .26* CSC .43* KSC -.74**	UNO .45**	UNO .44**	UNO .35** CSC .32*		UNO .33**							
GR6:PART	UNO .20*		UNL .72** CSC -.50**	UNL .45* CSC .30*	CSC .37* KSC .52*		UNO .25**	UNL .25*						
ANS-IE		UNL .34*	UNL .43*	The ANS-IE was not given at CSC, Spr. 78.			UNO .23*							
MSST		The MSST was only given at UNO Spr. 78.												
LSI:CE	KSC .67*		UNO .38** UNL .44* CSC .32*	CSC .40* KSC -.52*	KSC .55*		UNL .38*	UNL .33*						
LSI:RO			UNL .36*					UNO .37**	CSC .32*					
LSI:AC		UNO .30*	UNO .33** CSC .33*	UNO .29*		CSC .53**	UNO .26*	UNO .26*	UNO .24* UNL .48* CSC .32*	UNO .29* KSC -.58*				
LSI:AE	CSC .39*				CSC .32*			UNO .39**		UNL .44**	CSC .44**			
SI:AC-CE	KSC .78**	UNO .26*	UNO .35** UNL .36* CSC .40*	CSC .38*		UNL .33* CSC .46**	UNO .38** UNL .37*		-.55***	CSC .35*	.72***			
SI:AE-RO					CSC .38*				UNO .26*	-.74***		.67***		

The Kolb LSI was not used during the Fall, 1977.

The Kolb LSI was not used during the Fall, 1977.

Probability levels are: * $p < .05$
** $p < .01$
*** $p < .001$

Ns are approximately as follows:

Fall	UNO n=113
1977	UNL n=67
	combined n=180
Spring	UNO n=60
1978	UNL n=30
	CSC n=31
	KSC n=12
	combined n=133

Table 4. Significant correlations between the measures of cognitive style for Fall, 1977 (top half of matrix) and Spring, 1978 (bottom half of matrix).

<u>Cognitive Style Measure</u>	<u>Significant Main Effect</u>	<u>Means and ns</u>					
		<u>Social Science</u>	<u>Natural Science</u>	<u>Humanities</u>	<u>Business</u>	<u>Education</u>	<u>Other</u>
GEFT	Major F=4.50 df=5/97, p<.001	10.25 (13)	13.88 (18)	13.4 (17)	10.4 (41)	8.0 (21)	10.0 (5)
GR2:AVOD	Major F=2.82 df=5/97, p<.05	27.7	31.9	35.1	35.4	37.0	34.0
GR5:COMP	Major F=2.40 df=5/97, p<.05	40.7	41.4	46.5	44.7	40.7	40.0
GR6:PART	Major F=2.56 df=5/97, p<.05	61.8	59.6	62.2	59.2	54.9	60.0
		<u>Males</u>		<u>Females</u>			
GR2:AVOD	Sex F=15.98 df=1/97, p<.0001	36.78 (68)	30.13 (45)				
GR3:CLAB	Sex F=5.86 df=1/97, p<.05	54.69	58.0				
GR5:COMP	Sex F=5.22 df=1/97, p<.05	44.51	40.91				
GR6:PART	Sex F=10.17 df=1/97, p<.001	57.68	61.69				
MSST	Sex F=9.1 df=1/97, p<.01	-1.15	-2.76				

Table 5. Sex and Major main effects with cognitive styles as dependent variables, UNO and UNL Fall, 1977 data combined.

	Social Science	Natural Science	Human- ities	Business	Educa- tion	Other
GEFT		UNL (34) r=.32 p<.05				
GR3:AVOD	UNO (34) r=.37 p<.05	UNO (38) r=.28 p<.05			UNO (23) r=-.42 p<.05	
GR4:DEP						UNL (5) r=.97 p<.01
GR6:PART	UNO (34) r=.43 p<.01	UNO (38) r=.45 p<.01	UNO (56) r=.24 p<.05	UNO (8) r=.83 p<.01		
ANS-IE	UNL (19) r=.50 p<.05 UNO (37) r=-.37 p<.05					
MSST	UNO (39) r=-.28 p<.05					

Table 6. Significant correlations between cognitive style measures and GPA in fields.

	Social Science	Natural Science	Human- ities	Business	Educa- tion	Other
GEFT		UNO (122) $r=.23$ $p<.01$ UNL (62) $r=.34$ $p<.01$			UNL (62) $r=-.22$ $p<.01$	
GR1:IND						UNO (109) $r=.18$ $p<.05$
GR2:AVOD			UNO (109) $r=.29$ $p<.01$	UNO (109) $r=.20$ $p<.05$		
GR3:CLAB					UNO (109) $r=-.16$ $p<.05$	
GR5:COMP		UNO (109) $r=.19$ $p<.05$ UNL (63) $r=.23$ $p<.05$		UNO (109) $r=-.16$ $p<.05$		
GR6:PART			UNO (109) $r=-.29$ $p<.01$ UNL (63) $r=.34$ $p<.01$	UNO (109) $r=-.17$ $p<.05$		
ANS-IE					UNO (123) $r=.27$ $p<.01$	UNL (64) $r=.23$ $p<.05$
MSST					UNO (128) $r=.20$ $p<.05$	

Table 7. Significant correlations between cognitive style measures and hours in fields